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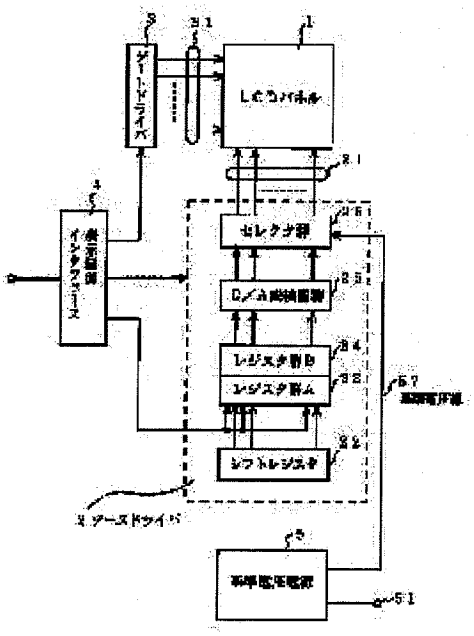
(54) LIQUID CRYSTAL DISPLAY DEVICE

(57)Abstract:
PROBLEM TO BE SOLVED: To make simply executable γ-correction in response to an optional operation mode, by selecting and switching the reference voltage corresponding to the level of the input video signal from reference voltages, and carrying out a specified γ-correction to the input image signal for display.
SOLUTION: Digitized image signals aligned temporally in series for picture elements are taken by registers of a register group A 23 as signals for picture elements and shifted to a register group B 24 via the control of a shift register 22. The output signals of the registers of the register group B 24 are converted into analog signals of sizes corresponding to the luminance of individual picture elements. The D/A-converted analog signals are replaced with the corresponding γ-corrected reference voltages by a selector group 26, and the reference voltages are source-applied to the liquid crystal elements of the picture elements of the display screen of an LCD panel 1. When the gate voltage of the liquid crystal elements is applied from a gate driver 3, the liquid crystal elements are displayed at the brightness corresponding to the voltages applied via the selector group 26.



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CLAIMS

[Claim(s)]
[Claim 1]A reference voltage generating part which is provided with the following and generates each reference voltage for a gamma correction, Reference voltage corresponding to a level of an

inputted video signal is chosen and changed out of said each reference voltage prepared for every level of said video signal, A liquid crystal display which is provided with a selector part which is replaced with an inputted video signal and supplied to an indicator, and is characterized by displaying on an inputted video signal by applying the appointed gamma correction.
A memory part which accumulates reference voltage data concerning a gamma correction for every operational mode corresponding to each level of a video signal.
A D/A converter which changes into corresponding reference voltage said reference voltage data of designated mode read from said memory part.

[Claim 2]Data concerning a gamma correction accumulated in a memory part, The liquid crystal display according to claim 1 characterized by enabling it to use data where data corresponding to the one or more modes in data concerning a gamma correction in graphics mode, natural drawing mode, and TV drawing mode is contained, and which is applied to a gamma correction in these each mode by selection.
[Claim 3]The liquid crystal display according to claim 1 or 2 characterized by reading data concerning a gamma correction accumulated in a memory part to a once rewritable memory, reading from said rewriting memory during operation by identical mode, supplying a reference voltage generating part, and making it generate predetermined reference voltage.
[Claim 4]Data concerning the 1st gamma correction accumulated in a memory part and data concerning the 2nd gamma correction are read to a memory rewritable, respectively, The liquid crystal display according to claim 1 or 2 characterized by making it generate reference voltage as data applied to a new gamma correction in data concerning a gamma correction which equalized and asked for both data.
[Claim 5]replacing with data concerning a gamma correction accumulated in a memory part, and writing data concerning arbitrary gamma corrections in a rewritable memory -- this data -- a basis -- the liquid crystal display according to claim 1 or 3 characterized by making it generate ****** reference voltage.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the liquid crystal display which can choose and display a favorite thing out of two or more sorts of gradation display properties.
[0002]
[Description of the Prior Art]Drawing 7 shows the lineblock diagram of the conventional liquid crystal display. It has the source line 210 which 100 is an LCD panel and constitutes a data line in a figure, and the gate line 310 which constitutes a scan line, A data signal is added to the source line 210 from the source driver 200, and it displays by adding a scanning signal to the gate line 310 from the gate driver 300. 400 is a display control interface which carves into the

digitization video signal 420 required for the display of LCD panel 100, the source driver control signal 430, and the gate driver control signal 440 the video signal supplied from the outside through the input signal line 410, and incorporates it. 500 is a reference voltage source for a multi-gradation display.

[0003]Next, operation is explained. By control of the shift register 220, the digitized video signal 420 is divided into the signal for every pixel, is incorporated into the register A230, and is changed into an analog signal with D/A converter 250 through the register B240. Voltage (reference voltage) which this analog signal voltage controls the analog switch of the selector 260, and has a pressure value after the gamma correction corresponding to said analog signal voltage It changes. The voltage after this gamma correction is impressed to the sauce of the liquid crystal element of the display pixel of LCD panel 1. Conversion on voltage with the pressure value after said gamma correction is performed as follows. Corresponding to the pressure value of the range which said analog signal voltage can take, the reference voltage power supply 500 which generates two or more voltage (reference voltage) with the pressure value of the size which multiplied the pressure value by the gamma correction coefficient is prepared. And it changes to the reference voltage from the reference voltage source which has said gamma correction value of the size corresponding to the pressure value of the analog signal for this analog signal voltage by control of analog signal voltage.

[0004]this reference voltage power supply 500 should carry out the partial pressure of the voltage from the regulated power supply 510 by resistance (R1 thru/or R10), and should pass an emitter-follower (EF1 thru/or EF0) -- it comprises the partial pressure circuit 520 to output, and reference voltage is sent out to the reference supply line 510. Corresponding to the specific gamma correction coefficient, each resistance of a partial pressure circuit is set up beforehand, and is incorporated.

[0005]

[Problem(s) to be Solved by the Invention]Since it had become the above composition with the device conventionally, in order to change a gamma correction coefficient, the combination of each resistance of a partial pressure circuit had to be changed, and it was not able to cater to the change request of the gamma correction coefficient in easy work. Since the image quality of a display became good, and the demand of making it like to be able to set up each time the gamma correction which suited each type would become strong if an opportunity to treat a screen various type increases, it became impossible however, to correspond in the stationary type thing of a conventional type.

[0006]An object of this invention is to provide the liquid crystal display which was made in order to cancel the above problems, and could be made to perform a change for two or more kinds of gamma correction coefficients simply.

[0007]

[Means for Solving the Problem]A memory part which accumulates reference voltage data which a liquid crystal display concerning this invention requires for a gamma correction for every operational mode corresponding to each level of a video signal, It has a D/A converter which changes into corresponding reference voltage said reference voltage data of designated mode read from said memory part, Out of said each reference voltage prepared for every level of a reference voltage generating part which generates each reference voltage for a gamma correction, and said video signal. Reference voltage corresponding to a level of an inputted video signal is chosen and changed, and it has a selector part which is replaced with an inputted video signal and supplied to an indicator, and it is made to display on it, applying the appointed gamma correction to an inputted video signal.

[0008]Data concerning a gamma correction accumulated in a memory part, Data corresponding to the one or more modes in data concerning a gamma correction in graphics mode, natural drawing mode, and TV drawing mode is contained, and it enables it to use data applied to a gamma correction in these each mode by selection.

[0009]Data concerning a gamma correction accumulated in a memory part is read to a once rewritable memory, and it reads from said rewriting memory during operation by identical mode, and is made to supply a reference voltage generating part.

[0010]Data concerning the 1st gamma correction accumulated in a memory part and data concerning the 2nd gamma correction are once read to a memory rewritable, respectively, It is made to generate reference voltage which a gamma correction costs by making into a new gamma correction coefficient data which equalized and asked for both data.
[0011]It replaces with data concerning a gamma correction accumulated in a memory part, writes in a memory which can rewrite data concerning arbitrary gamma corrections, and is made to generate reference voltage as data applied to a gamma correction coefficient in this data.
[0012]
[Embodiment of the Invention]
Embodiment 1. drawing 1 shows the lineblock diagram of the display for liquid crystals concerning this embodiment of the invention 1. In drawing 1, it is an LCD panel, and 1 is provided with the source line 21 and the gate line 31, adds a data signal to the source line 21 from the source driver 2, from the gate driver 3, it adds a scanning signal to a gate line, and displays. 4 It is a display control interface which divides the video signal from ****** into a signal required for the display of LCD panel 1. 5 is a reference voltage power supply for a multi-gradation display.
[0013]Next, operation is explained. By control of the shift register 22, the video signal which it was digitized and was put in order by series the whole pixel in time is incorporated into each register of the register group A23 as a signal for every pixel, and, subsequently to the register group B24, is moved. The output signal of each register of the register group B24 is changed into the analog signal of the size corresponding to the luminosity of pixel each by the D/A converter group 25, respectively. This analog signal is the selector group 26, it is replaced by the reference voltage after the gamma correction to which the analog signal after D/A conversion corresponds, and sauce impression of the liquid crystal element of each pixel of the display screen of LCD panel 1 is carried out. If the gate voltage of a liquid crystal element is impressed from the gate driver 3, a liquid crystal element will display the luminosity according to the voltage impressed through the selector group 26.
[0014]The relation between the analog voltage of a D/A converter and the reference voltage corresponding to this has shifted from the straight line according to the gamma correction coefficient. Specifically by display information, it is a relation (relation numerically shown in drawing 6) of drawing 5 in drawing 4 and TV drawing mode in drawing 3 and natural drawing mode in graphics mode. It is set up. In these figures, a horizontal axis is output voltage to which input data and a vertical axis correspond. This voltage supports the reference voltage (... V1, V10 ..) supplied from the reference voltage power supply 5. Since it has the above composition, in order to display by changing a gamma correction corresponding to each mode at every display, the reference voltage power supply 5 must generate the reference voltage made required the whole mode corresponding to the pressure value of the range which said analog signal can take in easy operation. The liquid-crystal-display measure concerning this invention constitutes as follows the reference voltage power supply 5 which generates the reference voltage which can satisfy such a demand.
[0015]Drawing 2 is a figure explaining the details of the reference voltage power supply 5. In drawing 2, a mode selection terminal and 52 51 The address conversion circuit according to mode, An address specifying part and 54 53 The voltage data of the reference voltage for every mode. for example, voltage data:V1a in the mode a, V2a, and ... V10a. The memory (ROM) which accumulates the voltage data which .. constructs, the rewritable memory groups (RAM) in which 55 was provided corresponding to each reference voltage, A RAM rewriting circuit and 59 are rewriting control terminals the D/A converter group provided 56 corresponding to each reference voltage, the reference voltage line by which 57 draws each reference voltage to said selector group 26, and 58.
[0016]Next, operation is explained. If the specification signal in the mode is impressed to the mode specification terminal 51, this mode designate signal will be changed into an address signal by the address conversion section 52 according to mode, It is led to the memory 54 through the address specifying part 53, the address of the voltage data of the reference voltage of the gamma correction of the designated mode currently stored in the memory 54 is specified, and this is read. The voltage data of the read reference voltage is once stored in the memory groups

55 which can be read. the data corresponding to each reference voltage accumulated in the form of digital data constructs this voltage data -- it is . this digital data -- constructing -- the reference voltage V1 in the mode of ******, V2, and ... V10 -- every of the D/A converter group 56 which supported .. and was prepared, respectively -- be changed into analog voltage with a D/A converter, and pass the reference voltage line 57 -- the selector group 26 is supplied. Since this voltage data can be specified, it can call and corresponding reference voltage can be generated if the voltage data corresponding to the reference voltage for every mode is accumulated in the memory 54 as mentioned above, the screen display to which the desired gamma correction coefficient was applied simply can be performed.
[0017]Although the case where read the data concerning 1 set of gamma correction coefficients, and a gamma correction was performed was explained, the above can read the data concerning 2 sets of gamma correction coefficients at a time, can compute the average value or weighted mean value of these two data, and can also perform a gamma correction using this. By this, the demand that he would like to apply interim amendment in the two modes can be met.Since reading can perform the stored data of the memory 55 which can be written in through the RAM rewriting circuit 58 from the rewriting directions terminal 59, The data temporarily read into the memory 54 other than the data beforehand prepared for the memory 54 can be used, and the gamma correction corresponding to the new mode can also be performed.
[0018]
[Effect of the Invention]Since the liquid crystal display concerning this invention memorizes the reference voltage data concerning a gamma correction in a memory, calls this, and changes it into voltage and it was made to use as reference voltage, By preparing for said memory as reference voltage data corresponding to arbitrary operational modes, it is effective in the ability to carry out a gamma correction easily corresponding to arbitrary operational modes.
[0019]Since a rewritable memory is provided and it was made to generate reference voltage with said memory using the memory information on this memory, a gamma correction can be carried out by arbitrary data, without being limited to the data memorized in said memory.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is an entire configuration figure concerning Embodiment 1.
[Drawing 2]It is a detailed lineblock diagram of the reference voltage power supply section concerning Embodiment 1.
[Drawing 3]It is an explanatory view about the gamma correction of graphics mode.
[Drawing 4]It is an explanatory view about the gamma correction in natural drawing mode.
[Drawing 5]It is an explanatory view about the gamma correction in TV drawing mode.
[Drawing 6]It is data concerning a gamma correction coefficient in which the input-and-output voltage relation in the various modes is shown.
[Drawing 7]It is a lineblock diagram of the conventional liquid crystal device.
[Description of Notations]

1 An LCD panel and 2 A source driver and 21 Source line group, 22 23 shift register and register group A, 24 register group B, 25 A D/A converter group, 26 selector groups, three gate drivers, and 31 [A video signal line and 43 / The source driver control line and 44 / The gate driver control line, 5 standard ********, and 51 mode selection terminals,] A gate line group and 4 Display control INTAFESU and 41 An input signal line and 42
52 The address conversion section according to mode, and 53 address specifying parts,
54 Memory , 55 rewritable memory groups,
56 A D/A converter group and 57 A reference voltage line, 58 RAM rewriting circuit, and 59 Rewrite control terminal.

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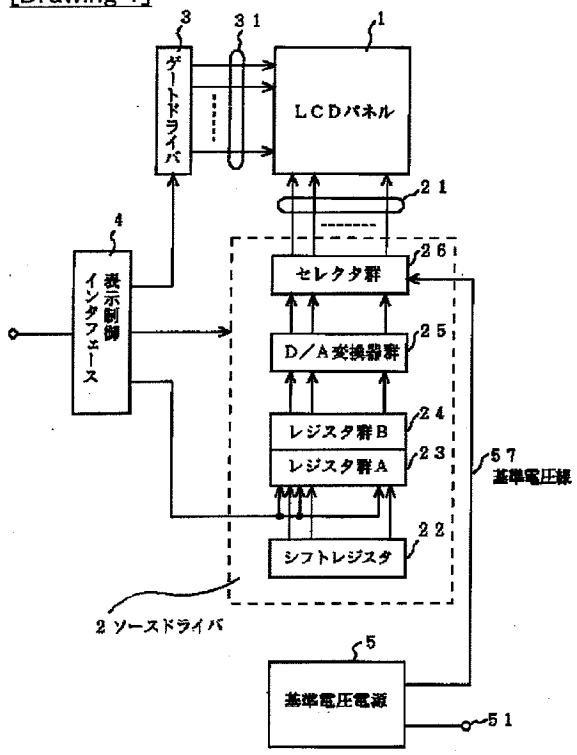
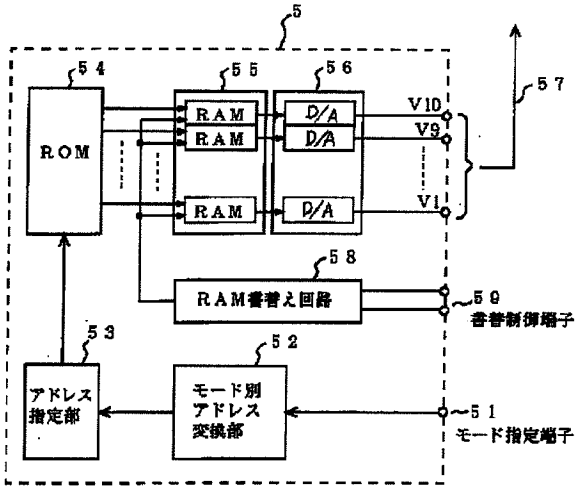
DRAWINGS

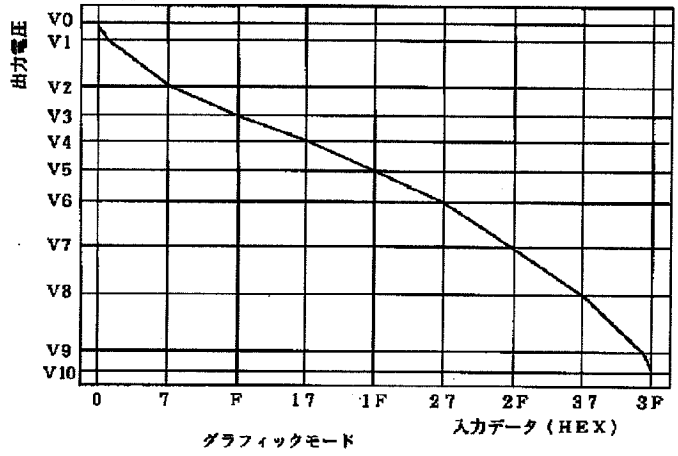
[Drawing 1]



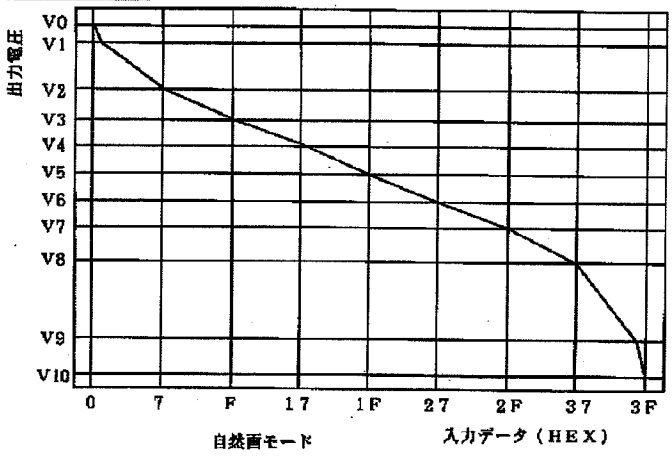
[Drawing 2]



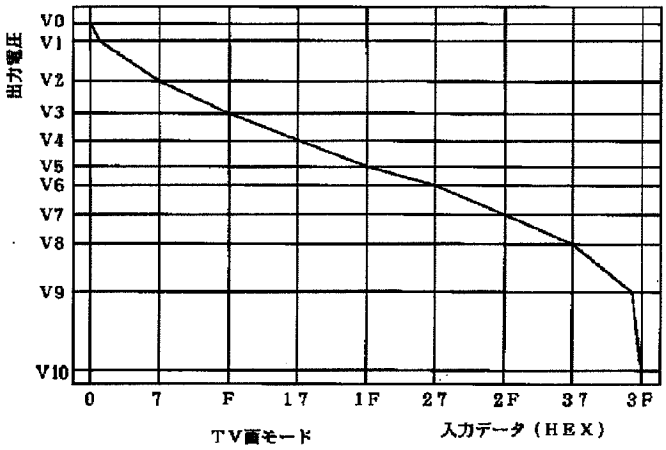
[Drawing 3]



[Drawing 4]



[Drawing 5]

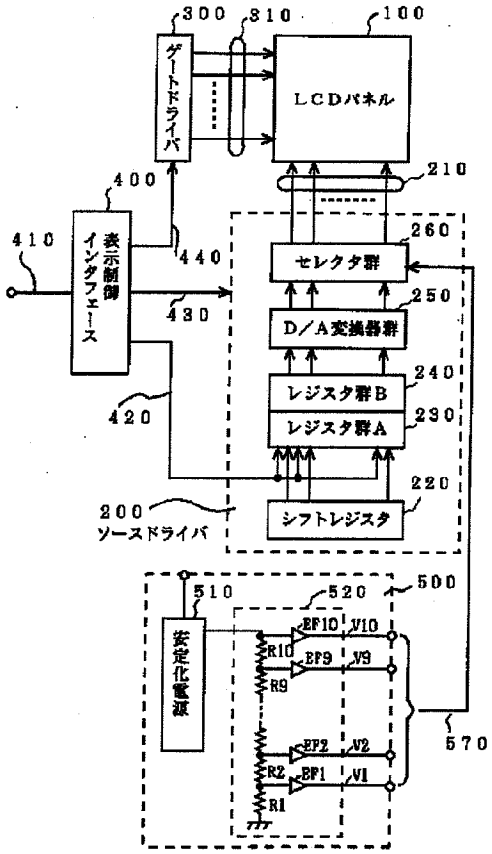


[Drawing 6]

各モード時の階調設定用データ（HEX）

	グラフィックモード	自然画モード	TVモード
V0	0B	0B	0B
V1	16	16	17
V2	35	2E	32
V3	49	43	4A
V4	5D	55	5B
V5	6F	67	6F
V6	83	76	7E
V7	A2	8A	91
V8	C2	9C	A8
V9	E7	BD	DC
V10	F4	F4	F4

[Drawing 7]



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